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ARTIFICIAL INTELLIGENCE AS AN INNOVATIVE TEACHING AND LEARNING STRATEGY TO ENHANCE CRITICAL THINKING AND PROFESSIONAL COMPETENCY IN NURSING STUDENTS: A SYSTEMATIC REVIEW

Zarina Shafi[*1], Victoria Samar[2], Shams Uddin Ghulam Rasool[3], Almas Chapsi[4], Shamim Chandani[5]

[*1]*Principal, Al-Tibri College of Nursing, Isra University*
[2]*Assistant Professor Liaquat Institute of Medical & Health Sciences, LUMHS, Thatta Campus*
[3]*Lecturer, Liaquat Institute of Medical and Health Sciences LUMHS Thatta Campus*
[4]*Nursing Director Advance Health Sciences College of Nursing*
[5]*Associate Dean, Baqai College of Nursing, Baqai University*

[*1]zarinashafi321@gmail.com, [2]victoriasamar14@gmail.com, [3]shams.mangrio222@gmail.com, [4]almas_chapsi@hotmail.com, [5]directornursing@baqai.edu.pk

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Corresponding Author: * Zarina Shafi

Abstract

Background: *In higher education, specifically in nursing education, artificial intelligence (AI) is meaningfully improving teaching approaches that prioritize students' attention spans, critical problem-solving abilities, and workforce readiness. The challenges of healthcare today necessitate that nursing students be taught the clinical and cognitive abilities they need to navigate the complex modern healthcare environments successfully.*

Materials and Methods: *This review utilized a systematic literature review methodology to identify, select, and synthesize relevant studies that explore the role of AI in enhancing critical thinking and professional competencies in nursing students. A structured search strategy was designed using key databases: PubMed, CINAHL, ScienceDirect, and Google Scholar. These databases were chosen for their comprehensive indexing of nursing and educational research articles.*

Result: *Three main strategies are provided by artificial intelligence to give nursing students greater opportunities to develop their professional skills and critical thinking abilities. Incorporating AI systems into nursing education boosts student engagement, prepares them for work in complex healthcare environments, and facilitates the development of essential nursing skills.*

Conclusion: *Artificial Intelligence in nursing education constitutes a tool which strengthens critical thinking abilities and increases students' professional capabilities. Individual educational opportunities emerge through the use of company-developed AI tools that include virtual simulations with adaptive learning platforms and intelligent tutoring systems, according to this review.*

INTRODUCTION

In higher education, exclusively in nursing education, artificial intelligence (AI) is meaningfully improving teaching approaches that prioritize students' attention spans, critical problem-solving abilities, and workforce

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readiness. The challenges of healthcare today necessitate that nursing students be taught the clinical and cognitive abilities they need to successfully navigate the complex modern healthcare environments. The present educational methods do not foster the critical thinking and decision-making abilities necessary for safe nursing practice (1).

AI educational technologies offer individualized learning experiences through chatbot interactions, adaptive learning platforms, virtual simulation systems, and intelligent tutors. Students can be involved in clinical simulations and receive real-time feedback by using these educational resources, which improves their capacity for self-evaluation and promotes deeper learning (2).

AI-assisted educational methods are very important in today's evidence-based practices. AI is considered very important part of today's modern education system (3).

AI tools permit self-directed learning, which lessens mental workload and permits students to study difficult material, thus increasing their speed of mastery (4). The essential nursing competencies of accuracy and empathy, together with fast decision-making abilities, can be trained at improved levels by AI, which reinforces their development. The integration of AI into educational systems has transformed faculty responsibilities from basic knowledge instructors to educational support providers and guidance mentors in modern technology-based learning spaces (5).

Little research exists about how AI impacts professional competency and critical thinking skills during nursing student training, particularly within low-resource areas. The review establishes an effort to connect this research gap by investigating how Artificial Intelligence enhances teaching methods, coupled with its effects on nursing education. The purpose involves demonstrating AI's capacity to develop cognitive abilities through skills advancement and competence training, which results in better clinical readiness of nursing graduates.

Materials and Methods:

This review utilized a systematic literature review methodology to identify, select, and synthesize relevant studies that explore the role of AI in enhancing critical thinking and professional competencies in nursing students. A structured search strategy was designed using key databases: PubMed, CINAHL, ScienceDirect, and Google Scholar. These databases were chosen for their comprehensive indexing of nursing and educational research articles. Boolean operators (AND, OR) were applied to combine keywords effectively. Search terms included: "Artificial Intelligence", "Nursing Education", "Critical Thinking", "Professional Competency", "Clinical Reasoning", "Virtual Simulation", and "AI in Teaching". For instance, a search string used in PubMed was: (“Artificial Intelligence” OR “AI”) AND (“nursing students” OR “nursing education”) AND (“critical thinking” OR “clinical judgment” OR “professional competence”).

To enhance the rigor of the review, filters were applied to include studies published within the last five years (2019–2024), peer-reviewed, available in full text, and in English. Exclusion criteria were studies unrelated to nursing education, editorials, conference abstracts, and non-peer-reviewed opinion articles. Systematic reviews and meta-analyses were included to capture broader trends and synthesize high-level evidence.

The initial search yielded 17,555 records. After removing duplicates and applying inclusion/exclusion criteria through title and abstract screening, 198 articles remained. These were subjected to full-text review, during which another 145 articles were excluded due to irrelevance or inadequate methodology. Ultimately, 26 high-quality studies were included in this review. Data from the selected articles were extracted and categorized based on themes such as AI tools used, teaching outcomes, student feedback, and competency development.

Most of the included studies employed experimental, quasi-experimental, or mixed-method designs, ensuring the inclusion of both quantitative outcomes and qualitative insights. This methodological approach allows for a comprehensive understanding of how AI enhances critical thinking and professional competency among nursing students, providing a robust evidence base to inform teaching practices and policy development.

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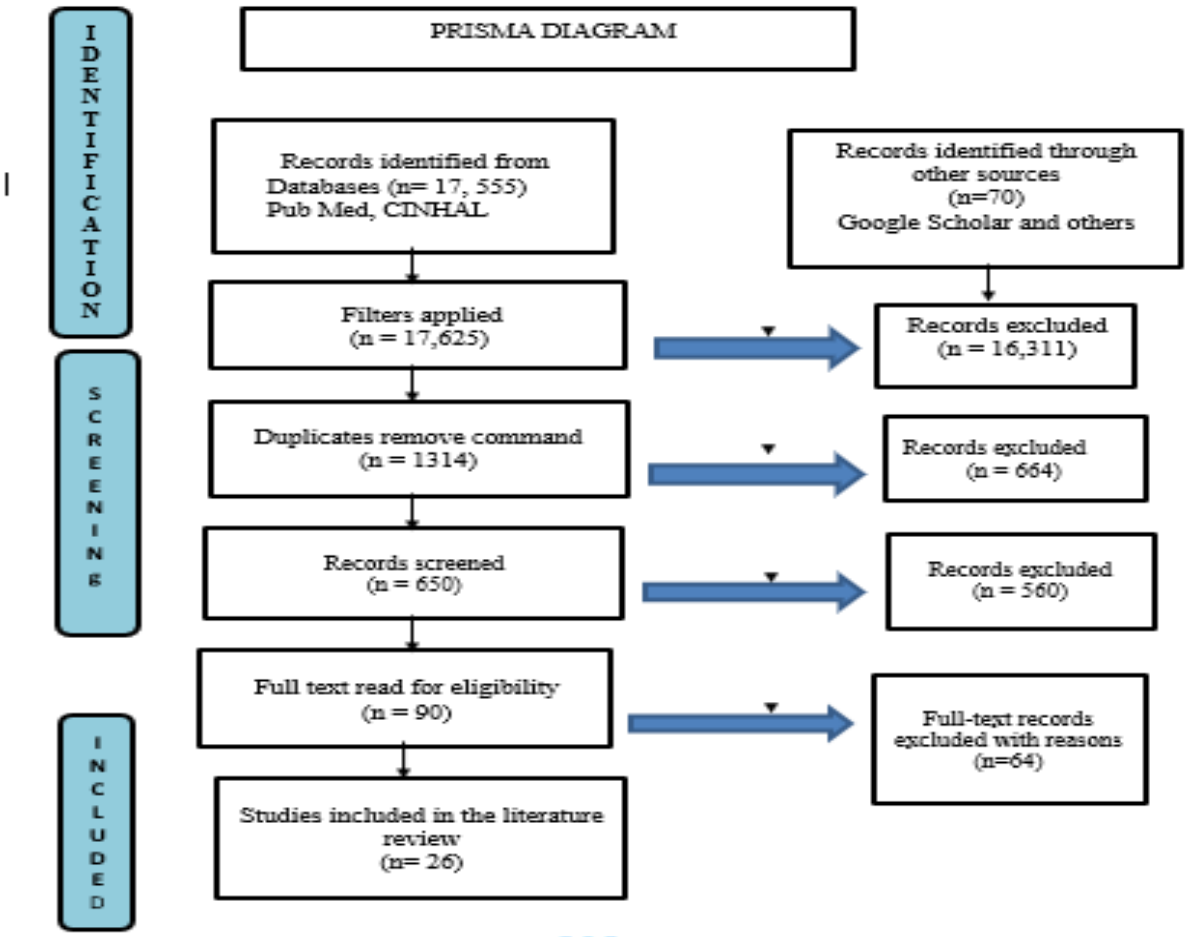
Prisma Chart:



Findings

Artificial Intelligence (AI) integration in education has shifted into a disruptive educational practice that benefits health sciences education, specifically nursing. Teaching methodologies and learning experiences transform due to AI technologies, which include virtual simulations and chatbots, intelligent tutoring systems, and adaptive learning platforms that create student-centered interactive methods to boost critical thinking and professional competencies (6). Healthcare complexity drives the requirement to teach nursing students advanced cognitive and clinical decision-making capabilities. The current teaching techniques lack effectiveness when it comes to developing necessary thinking competencies for clinical environments (7).

Enhancing Critical Thinking through AI

Critical thinking is mandatory for nurses because it enables them to perform analysis while evaluating situations with inference skills for making decisions in challenging clinical environments. The use of AI-based learning platforms creates realistic, interactive educational spaces for students to perform scenarios that enhance their understanding and make them reflectively think (8). AI technology enables nursing students to perform clinical skills safely and receive instant performance reviews (9). Students enrolled in South Korean AI simulation programs showed better critical thinking ability than their peers in regular classrooms, according to study results (10).

Artificial Intelligence tools allow learners to proceed at their own pace when studying because they can access information according to their personal learning requirements and learning preferences, thus increasing both student mental engagement and

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understanding (11). Intelligent tutoring systems use Socratic method-based practices to guide learners by asking complex topic questions and providing methods of feedback to enhance critical thinking skills (12). Research conducted in the United States demonstrated that nursing students worked with AI chatbot assistants to develop better capabilities in diagnostic assessment and proper prioritization (13).

Advancing Professional Competency

Nursing professionals need to demonstrate three core abilities, which integrate clinical skills with communication abilities and ethical standards, as well as team-building competencies. The AI-based simulation platforms help students achieve competency through the representation of interdisciplinary team dynamics combined with ethical scenarios and urgent clinical response tasks (14). AI systems that replicate communication interactions between healthcare professionals enable students to develop better clinical judgment and team-oriented care abilities (15). This Canadian study examining AI-trained curriculum found that the integration led students to advance their clinical expertise and their competency in practice application (16).

Through AI, students can develop continuously through assessment monitoring, which reveals learning deficiencies and matches learners' advancement patterns. The model enhances professional nurse attributes through self-directed learning and accountability mechanics (17). Through AI, students can engage in reflective learning because they obtain the chance to review their decisions with their effects, leading to lifelong learning and professional advancement (18).

Faculty and Institutional Perspectives

Nursing education faces new developments because AI technologies are being integrated into the field of effective teaching practices. Educational staff now function as facilitators who do not limit themselves to being content deliverers. The educators support students through the interpretation of AI-generated feedback before students can integrate it into clinical practice (19). Educational use of artificial intelligence systems requires time for adjustment, but some teachers doubt how these tools will impact their workload and patient information security, and nursing education core values (20). A thorough review of research showed that faculty training plays a vital part in both teaching AI-based curriculum approaches and gaining faculty approval (21).

Scripts for AI technology implementation in institutions require comprehensive investments that must include developing training programs for teachers and changes to educational plans (22).

Global Trends and Challenges

People globally understand how artificial intelligence can reshape nursing education programs. Low- and middle-income countries experience obstacles with AI adoption because they have restricted technological infrastructure and insufficient faculty training (23) despite High-income countries leading AI tool adoption. The use of affordable Artificial Intelligence applications within student learning environments has demonstrated successful results through programs implemented throughout India, South Africa, and the Philippines, according to research (24).

Educational institutions must address ongoing ethical as well as regulatory matters concerning their use of AI. Data protection, along with student privacy concerns and algorithmic bias problems, and digital divide problems, must get proper resolution to ensure students obtain equal AI-based nursing education access while using AI responsibly (25). The nursing profession requires institutions to validate that AI systems work alongside human connection since personal touch stands as vital to nursing practice (26).

Gap Analysis:

Despite growing evidence that Artificial Intelligence (AI) enhances critical thinking and professional competency in nursing education through simulations, adaptive platforms, and intelligent tutoring systems, significant gaps remain. Most existing studies emphasize short-term improvements without longitudinal data to confirm the sustained impact of AI on clinical practice. Additionally, there is limited exploration of faculty preparedness, institutional readiness, and ethical challenges such as data privacy, algorithmic bias, and the preservation of humanistic care in AI-assisted environments. The global divide in technological infrastructure and faculty training further restricts equitable AI

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adoption, especially in low- and middle-income countries, highlighting the need for inclusive implementation strategies and standardized policies across diverse educational settings.

Conclusion

Artificial Intelligence in nursing education constitutes a tool that strengthens critical thinking abilities and increases students' professional capabilities. Individual educational opportunities emerge through the use of company-developed AI tools that include virtual simulations with adaptive learning platforms and intelligent tutoring systems, according to this review. These implemented AI tools help advanced students build their diagnostic expertise together with clinical decision-making abilities, which healthcare professionals need in current practice.

AI systems create educational systems focusing on student needs, and they facilitate adaptable learning that matches the individual progress needs of nursing professionals. AI technology enables the development of connective educational situations that combine theoretical concepts with practical clinical activities. The adoption of AI for nursing education provides numerous positive effects, yet success depends on solving faculty instruction challenges and handling data security issues, along with addressing technical restrictions that exist in underserved areas.

AI serves best when used as an additional educational system that improves nursing educational methods and generates potential training opportunities for both students and faculty members.

Recommendations

The review findings confirm the recommendations, which will ensure the best AI implementation practice in nursing education programs.

1. Faculty Development and Curriculum Integration

Educational facilities serving nursing students need to develop teaching programs that instruct their faculty members about appropriate AI tool utilization.

Institutional curricula must undergo redesign to incorporate AI-based learning solutions for developing three essential skill groups: critical thinking ability, along with ethical thinking, and clinical decision competency.

2. Enhanced Student Access to AI Resources

Access to industrial platforms that unite artificial intelligence with virtual simulation capabilities and adaptive learning resources should stay available for student nurses to support their individualized education.

The government, together with institutions, needs to distribute technological resources equally between low- and middle-income background areas.

3. Support the ethical, along with humanistic, utilization of AI systems.

Educational institutions should create standard operating procedures that protect student data privacy, together with algorithmic bias supervision and ethical requirements of AI-based instruction methods.

Nurses should implement AI technology to support humanistic values through programs that enable empathy and better communication, and patient-focused care.

4. Foster Global Collaboration and Innovation

Nursing educational facilities worldwide should establish collaboration arrangements that facilitate the sharing of best practices and conduct research together for developing cost-effective AI applications.

The organization will back initiatives about AI at the pilot stage and community level to prove its value across various educational and clinical environments.

5. The use of artificial intelligence for healthcare requires additional research investigation to determine its effects.

Educational research must pursue continuous tracking of AI effectiveness to determine its long-term benefits in advancing critical thinking skills and clinical competency, and career readiness skills of nursing graduates.

Analysis of ROI, along with implementation designs and cultural suitability testing, must be conducted for AI educational technologies during their implementation across different learning environments.

Education stakeholders, composed of nurses alongside policymakers and developers, must collaborate to unlock the complete potential of AI by using these proposed guidelines. Future nurses will be

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better prepared to handle current healthcare requirements through enhanced critical thinking and professional competency in nursing students.

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